Appendix R
Compilation of environmental mitigation measures

Compilation of environmental mitigation measures

Management of construction impacts

A Construction Environmental Management Plan(s) (CEMP) will be prepared for the project and may be developed as a series of complementary and coordinated CEMPs to address specific construction sites, construction activities or stages during the construction period. The CEMP(s) will detail the approach to environmental mitigation, management, monitoring and reporting during construction of the project. The CEMP(s) will provide a consolidated environmental management framework, supplemented by more detailed sub-plans and other documentation focused on key environmental issues during construction. Key environmental issues will include those identified through this environmental impact statement (EIS), the requirements of conditions of approval that may be applied to the project and the outcomes of ongoing stakeholder engagement carried out consistent with the Stakeholder Engagement Strategy for the Upgrade Program (refer below).

Key issues that will be addressed in the CEMP(s), where relevant, will include:

- minimisation and management of air emissions, including dust generation and emissions from plant and equipment
- minimisation and management of noise and vibration, including construction scheduling, protocols for the management of noisy activities outside standard construction hours, protection of sensitive structures and receivers from vibration, and management of ground vibration during tunnelling
- management of construction traffic, including site access arrangements and minimisation of impacts associated with heavy vehicle movements, including spoil haulage
- management of water, including surface, groundwater and wastewater, treatment and reuse standards, discharge locations and requirements, mitigation and management of erosion and sedimentation risks and management of works within areas prone to flooding
- protection of Aboriginal and non-Aboriginal heritage during construction, procedures for managing and salvage of archaeology where relevant, and protocols for the management of unexpected finds
- protection of biodiversity within and around construction sites
- mitigation and management of potential impacts on social infrastructure and businesses, including access requirements, notifications and engagement, and property impacts
- management of waste, including transport and disposal requirements, and resource efficiency and sustainability measures.

Further details of issue-specific sub-plans and other documentation that will be prepared to support, inform and complement the CEMP(s) are provided in Table 2.

A Stakeholder Engagement Strategy has been prepared for the Upgrade Program and would be used to guide community and stakeholder engagement activities during construction of the project. Engagement during construction will include updates on planned construction activities and will respond to concerns and enquiries in a timely manner, seeking to minimise potential impacts where possible.

Management of operational impacts

During operation, the project's environmental performance will be managed under Transport's existing environmental management system (or similar), prepared in accordance with the AS/NZS ISO 14000 Environmental Management System series. Detailed operational policies and

procedures specific to the project will be developed consistent with the environmental management system, and to reflect project-specific requirements arising from the assessments presented in this EIS, conditions of approval that may be applied to the project, and other issues that may arise through ongoing consultation with stakeholders. Key areas of focus for operational policies and procedures will be typical of the operational environmental issues already managed across the existing State road network and other major road tunnels in Sydney. These operational environmental issues may include:

- ongoing environmental monitoring and associated adaptive mitigation measures
- tunnel air quality and ventilation system management
- traffic management, including management of breakdowns and other traffic incidents
- emergency management, both within the project tunnels and through external events such as bushfires
- maintenance of project landscaping and visual appearance
- sustainability, resource efficiency and waste management
- environmental management of project maintenance activities.

Performance outcomes

Performance outcomes have been developed consistent with the requirements of the Planning Secretary's environmental assessment requirements (SEARs) for the project. The performance outcomes for the project are identified in Table 1 and identify measurable, performance-based standards for environmental management. Mitigation measures, including measures necessary to achieve the performance outcomes, are identified in Table 2.

Table 1 Consolidated list of performance outcomes

SEARS desired performance outcome	Project performance outcome	Timing
Traffic and transport		
Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts.	Avoid or minimise adverse impacts to the performance of the existing road network, including with respect to level of service, travel times and road safety.	Construction and operation
The safety of transport system customers is maintained.		
Impacts on network capacity and the level of service are effectively managed.		
Works are compatible with existing infrastructure and future transport corridors.	Coordinate and deliver the project as part of the integrated package of works comprising the Upgrade Program.	Construction and operation

SEARS desired performance outcome	Project performance outcome	Timing
Air quality		
The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent practicable.	Design, construct and operate the project to achieve applicable amenity and human health based in-tunnel and ambient air quality criteria, including in relation to nuisance dust and odour.	Design, construction and operation
Human health		
The project avoids or minimises any adverse health impacts arising from the project.	Design, construct and operate the project to achieve applicable human health based in-tunnel and ambient air quality criteria, and human health based noise and vibration criteria.	Design, construction and operation
The project avoids, to the greatest extent possible, risk to public safety.	Design, construct and operate the project to comply with applicable road design and road safety standards, guidelines and policies.	Design, construction and operation
Noise and vibration		
Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity, and adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage. Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community. Increases in noise emissions and vibration affecting environmental heritage as defined in the *Heritage Act 1977* during operation of the project are effectively managed.	Construct the project to avoid or minimise exceedances of applicable noise management levels. If exceedances of noise management levels cannot be reasonably and feasibly avoided, develop and apply situation-specific construction noise mitigation and management measures.	Construction
	Construct the project to avoid or minimise exceedances of applicable structural integrity (including for sensitive structures and heritage items) and human comfort vibration standards. If exceedances of vibration standards cannot be reasonably and feasibly avoided, develop and apply situation-specific vibration mitigation and management measures.	Construction
	Design the project to minimise the magnitude and extent of material adverse changes to road traffic noise (≥2dB(A)) at existing sensitive receiver locations during operation of the project.	Design

SEARS desired performance outcome	Project performance outcome	Timing
Biodiversity		
The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity.	Design the project to minimise adverse impacts on native terrestrial and aquatic flora and fauna.	Design
The offsets and/or biodiversity conservation actions are assured and are equivalent to any residual impacts of project construction and operation.	Secure a biodiversity offset and/ or carry out a conservation action equivalent to no less than the impacts of the detailed design of the project on biodiversity as assessed using the NSW Biodiversity Assessment Method (BAM) (2020).	Construction and operation
Groundwater and geology		
Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved).	Design and operate the project to minimise adverse long term impacts on surface water and groundwater, and related environmental values, including: • minimising the volume and rate of groundwater inflow to the project during operation • minimising the magnitude and extent of groundwater drawdown around the project during operation • minimising the reduction in baseflow volumes in watercourses affected by groundwater drawdown around the project during operation • surface water discharge from the project, including site runoff and water treatment plant discharges, achieves a neutral or beneficial effect on the receiving watercourse and catchment, taking into account relevant Water Quality Objectives.	Design, construction and operation
Consideration of tunnel boring methods to minimise groundwater drawdown impacts and dewatering.	Design and construct the project to minimise groundwater inflow and groundwater drawdown around the project during construction and operation.	Design, construction and operation

SEARS desired performance outcome	Project performance outcome	Timing
The project is designed, constructed, and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).	Manage surface water discharges from the project during construction and operation, including collection and treatment where necessary, to achieve a neutral or beneficial effect on the receiving watercourse and catchment, taking into account relevant Water Quality Objectives.	Design, construction and operation
Surface water and flooding		
Flooding The project minimises adverse impacts on existing flooding characteristics.	Design and construct the project to minimise adverse effects on existing flooding characteristics, to meet relevant standards, guidelines and policies and meet the flood design criteria developed for the project.	Design and construction
Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.	Design and construct the project to achieve flood immunity consistent with design standards, guidelines and policies for road and tunnel infrastructure and meet the flood design criteria developed for the project.	Design and construction
Water – Hydrology Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved).	Design and operate the project to minimise adverse long term impacts on surface water and groundwater, and related environmental values, including: • minimising the volume and rate of groundwater inflow to the project during operation • minimising the magnitude and extent of groundwater drawdown around the project during operation • minimising the reduction in baseflow volumes in watercourses affected by groundwater drawdown around the project during operation • discharging surface water from the project, including site runoff and water treatment plant discharges, to achieve a neutral or beneficial effect on the receiving watercourse and catchment, taking into account relevant Water Quality Objectives.	Design, construction and operation

SEARS desired performance outcome	Project performance outcome	Timing
Sustainable use of water resources.	Design, construct and operate the project to minimise the volume of water and rate of water consumption required during construction and operation. Subject to quality and volume requirements, maximise the reuse and recycling of water within the project.	Design, construction and operation
Water – Quality The project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project to the extent of the project impact including estuarine and marine waters (if applicable).	Manage surface water discharges from the project during construction and operation, including collection and treatment where necessary, to achieve a neutral or beneficial effect on receiving watercourses and catchments, taking into account relevant Water Quality Objectives.	Design, construction and operation
Soils and contamination		
The environmental values of land, including soils, subsoils and landforms, are protected.	Design and construct the project to minimise the disturbance of soils and changes in landform. Rehabilitate disturbed land that is not required for operational infrastructure to a state comparable with its pre-disturbance condition or as otherwise agreed with the landowner.	Design and construction
Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination.	Characterise and evaluate the risks associated with land and soils affected by the project prior to disturbance, including with respect to potential contamination and acid sulfate soils. Develop and implement management measures specific to the characteristics and risks of land and soils to be disturbed, including the preparation of a Remedial Action Plan for contaminated land where relevant.	Construction
Aboriginal cultural heritage		
The design, construction and operation of the project facilitates, to the greatest extent	Avoid or minimise direct and indirect impacts on known or unexpected Aboriginal values, objects and places.	Construction

SEARS desired performance outcome	Project performance outcome	Timing
possible, the long term protection, conservation and management of the heritage significance of Aboriginal objects and places. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of Aboriginal objects and places.	Incorporate Aboriginal heritage interpretation and Aboriginal cultural design principles into the design of the project in consultation with Aboriginal stakeholders.	Design
Non-Aboriginal heritage		
The design, construction and operation of the project facilitates, to the greatest extent possible, the of long term protection, conservation and management of the heritage significance items of environmental heritage value. The design, construction and operation of the project avoids or minimises impacts, to the greatest extent possible, on the heritage significance of environmental heritage value.	Avoid direct and avoid or minimise any indirect impacts to the World Heritage listed Greater Blue Mountains Area.	Construction
	Avoid or minimise direct and indirect impacts to existing heritage items listed on statutory heritage lists and registers. Where a direct or indirect impact cannot be avoided, develop mitigation and management measures reflecting the long term protection, conservation and management of the affected heritage item.	Design and construction
	Where disturbance of known and suspected areas of potential archaeological significance cannot be avoided, carry out investigations of the areas of potential archaeological significance in accordance with applicable guidelines, prior to disturbance and minimise the extent of disturbance.	Design and construction
Urban design, landscape and visual		
The project is well designed and enhances the environment where is it located, including improved accessibility and connectivity for communities and public spaces. The project helps to support the health and wellbeing of Country by valuing, respecting and being guided by Aboriginal people.	Design the project to respond to the surrounding landscape character and integrate the design of built and natural environments in an understandable, complementary, and sustainable way, establishing a robust Connection to Country. Incorporate Aboriginal heritage interpretation and Aboriginal cultural design principles into the design of the project in consultation with Aboriginal stakeholders.	Design
The project contributes to greener places through the	Design and construct the project to include green infrastructure as part of surface operational infrastructure, where feasible.	Design and construction

SEARS desired performance outcome	Project performance outcome	Timing
enhancement and provision of green infrastructure.		
Social impacts		
The project is designed to provide socially sustainable outcomes. The project will maximise the social and economic welfare of the community. The project will deliver better development outcomes by minimising negative social impacts and enhancing positive social impacts on affected communities	Design and implement the project to provide a net positive social and economic outcome, including: • avoiding or minimising the environmental impacts of the project during construction and operation (refer to project objectives in other areas) • avoiding or minimising direct and indirect impacts on social infrastructure • avoiding or minimising disruptions to local businesses during construction • maximising project employment within the region during construction and operation • develop and implement clear, timely and inclusive stakeholder engagement and information measures.	Design, construction and operation
Business, land use and property		
The project minimises adverse impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure. The project maximises positive impact opportunities	Design and implement the project to provide a net positive property, businesses and land use outcome, including: • avoiding or minimising the environmental impacts of the project during construction and operation (refer to project objectives in other areas) • minimising the construction and operational footprints of the project • avoiding or minimising disruptions to local businesses during construction • rehabilitating disturbed land that is not required for operational infrastructure to a state comparable with its pre-disturbance condition.	Design, construction and operation
Resource use and waste management		
All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.	Manage waste in accordance with the resource management hierarchy including minimisation and reuse of waste to protect environmental values.	Construction and operation

SEARS desired performance outcome	Project performance outcome	Timing
Sustainability, climate change and greenhouse gas		
The project is designed, constructed and operated to be resilient to the future impacts of climate change.	Design and implement the project taking into account current climate change projections and potential future climate change impacts.	Design, construction and operation
The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources. Conservation of natural resources is maximised.	Design and implement the project to minimise capital and operational costs, consistent with NSW Treasury requirements. Design and implement the project to achieve a minimum Infrastructure Sustainability 'Design' and 'As-Built' rating of 'Excellent' under version 1.2 of the ISC rating tool.	Design, construction and operation

Project-specific environmental mitigation measures

Mitigation measures have been developed to mitigate and manage the potential construction and operational impacts of the project and to achieve the performance outcomes identified in the EIS. These mitigation measures are compiled in Table 2.

These mitigation measures may be revised in response to submissions received during public exhibition of the EIS and/or project design development following exhibition. The revised list of mitigation measures will be provided in the Response to Submissions and project Amendment Report (if required).

Table 2 Consolidated list of mitigation measures

ID	Environmental mitigation measure	Timing
Transport and traffic		
TT1	A Construction Transport and Access Management Plan (CTAMP) will be prepared as part of the Construction Environmental Management Plan (CEMP) in consultation with the relevant local councils and emergency services. The CTAMP will include: • measures to minimise and manage construction traffic and road safety impacts on other road users, including pedestrians, cyclists and buses • planning to minimise the movement of construction heavy vehicles during the AM and PM peak hours, weekend peak hours and on peak weekends (such as the Bathurst Super Car event) and public holidays, where practicable • access management measures, including safety measures, for active transport interfaces with construction areas and construction sites • measures to provide safe and adequate access to residential premises and businesses during construction, particularly where construction activities affect existing property access arrangements • details of the types of temporary traffic management measures that would be required during construction, such as posted speed limit	Construction

ID	Environmental mitigation measure	Timing
	reductions, detours and full or partial road closures, and how these measures would be managed to minimise impacts on other road users • measures to periodically update local emergency services on the staging and progress of construction works, and to maintain safe adequate access for emergency services during the construction period • a framework for coordinating construction planning and traffic management with adjacent Great Western Highway upgrade projects to minimise potential cumulative construction traffic impacts.	
TT2	Sufficient car parking spaces will be provided within the project construction sites to accommodate anticipated construction worker parking requirements. During detailed construction planning, opportunities to provide a shuttle bus or other initiatives to transfer construction workers from local hubs to construction sites will be investigated.	Design and construction
TT3	Opportunities to minimise the impacts of construction traffic on the level of service at the Great Western Highway/ Evans Lookout Road intersection and the Great Western Highway/ Browntown Oval intersection will be investigated during detailed construction planning.	Design and construction
TT4	The operational traffic performance of the project will be reviewed 12 months after commencement of operation. The review will aim to confirm the predicted positive effects of the project on the road network and, if relevant, identify adverse operational traffic impacts on road network performance. In the event that adverse operational traffic impacts on the road network are identified, opportunities to mitigate these impacts will be considered for implementation.	Operation
Air quality		
AQ1	Construction activities will be managed to minimise the emission of visible dust beyond the construction footprint. Measures to minimise the generation and emission of dust will be detailed in the Construction Environmental Management Plan (CEMP), and applied to relevant construction locations and construction activities. Dust mitigation measures for each location/ activity may include one or more of the following: • visual inspection of construction sites to identify sources of dust emissions, taking into account weather conditions (particularly dry and windy conditions) and the scale, nature and intensity of construction activities • scheduling of dust generating activities to minimise potential for elevated cumulative dust generation • location and management of dust generating stockpiles away from sensitive human and ecological receptors • application of measures to minimise dust generation from surfaces and stockpiles, such as sealing (or other treatment), application of water sprays, covers and enclosures, dust barriers or similar • progressive site rehabilitation or stabilisation to minimise the potential for and duration of dust generation from disturbed areas	Construction

ID	Environmental mitigation measure	Timing
	• implementation of speed limits on unsealed roads and other trafficked surfaces.	
AQ2	Air emissions from construction plant and equipment will be minimised by: • using mains electricity or battery powered equipment instead of diesel- or petrol-powered generators where practicable • switching off vehicles, plant and equipment when not in use • using lower emissions plant and equipment where feasible and reasonable.	Construction
AQ3	Dust emissions from construction vehicles travelling to or from the construction footprint will be minimised by: • covering dust generating loads where practicable • implementing a wheel washing system at relevant construction site access points (with rumble grids to dislodge accumulated dust and mud prior to leaving the site) where practicable • using water-assisted sweepers or similar on access roads around the construction footprint to remove any material tracked onto those roads by construction traffic.	Construction
AQ4	The existing air quality monitoring program will be reviewed in consultation with relevant stakeholders and updated and implemented to confirm the in-tunnel air quality and ambient air quality performance of the project during the first two years of operation.	Operation
AQ5	The tunnel walls will be cleaned as part of routine maintenance to reduce concentrations of small particles.	Operation
AQ6	If required, in-tunnel air quality will be managed by temporary in-tunnel traffic management measures. These temporary measures will be communicated to tunnel users using a range of methods including traffic lights, barriers, variable message signs, radio broadcasts and public address systems (used in emergencies).	Operation
Noise and vibration		
NV1	A Construction Noise and Vibration Management Plan (CNVMP) will be prepared as part of the Construction Environmental Management Plan (CEMP) in consultation with relevant stakeholders. The CNVMP will be prepared consistent with the *Construction Noise and Vibration Guideline (for Road and Maritime Works)* (Transport for NSW, 2022b) and will include: • identification of potentially significant noise and vibration generating construction activities and locations based on detailed design and construction planning, and associated potentially affected noise and vibration sensitive receivers • details of construction noise management levels and vibration goals applicable to each sensitive receiver or group of receivers • identification of feasible and reasonable measures to be implemented during construction to minimise noise and vibration impacts, such as working hours, staging, placement and operation of work sites, parking and storage areas, temporary noise barriers,	Construction

ID	Environmental mitigation measure	Timing
	haul road maintenance and controlling the location and use of vibration generating equipment • details of specific measures to be applied in circumstances where construction noise management levels and/ or vibration goals will not be met at noise sensitive receivers • a monitoring program to monitor and assess the performance of construction activities against the applicable construction noise management levels and vibration goals • arrangements for consultation with potentially affected noise and vibration sensitive receivers, including notifications of planned construction works and complaint handling procedures • a procedure for considering and managing construction activities outside standard construction hours, including approval processes, activity planning and scheduling, receiver notification and engagement procedures, and mitigation and management measures.	
NV2	The procedure for considering and managing construction activities outside standard construction hours (refer to NV1) will consider activities that will be carried out 24 hours per day, seven days per week, including: • underground construction, including tunnel boring machine and roadheader tunnelling methodology and construction of roads and other infrastructure within tunnels • spoil handling within the tunnels and acoustic shed • spoil haulage • tunnel fit-out including mechanical and electrical fit-out • mechanical and electrical fit-out of operational buildings • emergency work.	Construction
NV3	Noise sensitive receivers likely to be affected by noise or vibration in excess of the applicable construction noise management level or vibration threshold will be notified of the relevant construction activities prior to the commencement of those activities. The notification will include details of: • the relevant construction activities • the anticipated construction period and construction hours • contact information for a construction management stakeholder interface • complaint and incident reporting and how to obtain further information. Feedback provided by affected noise sensitive receivers will be considered when developing a final mitigation strategy to manage construction noise impacts.	Construction
NV4	Construction activities at Blackheath and Soldiers Pinch will be carried out during standard construction hours where feasible and reasonable. Construction activities with the potential to generate high noise levels (75 dB(A) L_{Aeq} at receiver) and/or vibration levels will be scheduled during less sensitive time periods where feasible and reasonable. Any construction activity carried out outside standard construction hours at Blackheath and Soldiers Pinch will be subject to the out of hours	Construction

ID	Environmental mitigation measure	Timing
	construction activity procedure detailed in the CVNMP, including consultation with the affected local community.	
NV5	Following detailed design, the owners of properties identified for architectural treatment to mitigate operational traffic noise impacts will be consulted in relation to the potential early application of architectural treatments in cases where those properties are also likely to experience construction noise impacts in excess of applicable construction noise management levels. If agreed with the property owner, the architectural treatment will be applied as early as possible to mitigate construction noise impacts.	Design and construction
NV6	Construction activities will be planned and carried out to minimise noise and vibration impacts on sensitive receivers. Where relevant, this may include application of the following types of measures to individual construction sites and activities: • construction sites will be configured to maximise the distance and/ or provide shielding between noisy plant and equipment and sensitive receivers, where feasible and reasonable • site sheds, earth bunds and hoarding will be positioned to provide shielding between noisy plant and equipment and sensitive receivers, where feasible and reasonable • materials/ deliveries will be loaded and unloaded as far as practicable from sensitive receivers, and/ or loading/ unloading areas will be shielded • construction sites will be configured to minimise the need for reversing vehicles, particularly for regular/ repeatable movements • non-tonal reversing beepers (or an equivalent mechanism) will be fitted and used on construction vehicles and mobile plant regularly used on site • vibration intensive equipment will be selected based on the structural damage minimum working distances. The use of less vibration intensive methods of construction or equipment will be considered where feasible and reasonable.	Design and construction
NV7	Where the use of vibration intensive equipment within the relevant minimum working distance from a building or structure cannot be avoided, a detailed inspection of the building or structure will be carried out prior to the commencement of the vibration intensive work. A written and photographic report will be prepared to document the condition of building or structure, and a copy of the report will be provided to the relevant landowner or land manager.	Construction
NV8	A framework will be developed and implemented for coordinating construction planning and traffic management with adjacent Great Western Highway upgrade projects to minimise potential cumulative construction noise and vibration impacts where practicable.	Design and construction
NV9	During detailed design, options to minimise jet fan break out noise from tunnel portals (such as jet fan selection or use of noise attenuation devices) would be investigated, with the aim of not exceeding applicable controlling noise criteria at affected receivers where feasible and reasonable.	Design

ID	Environmental mitigation measure	Timing
NV10	Within 12 months of commencement of operation of the project, a post-construction operational compliance assessment will be carried out in accordance with Chapter 6 of *Road Noise Model Validation Guideline* (Transport for NSW, 2022e).	Operation
Biodiversity		
B1	The project will be designed and implemented to minimise the removal of native vegetation and to minimise impacts to threatened species and their habitats.	Design and construction
B2	The project will be designed and constructed to minimise disturbance and impacts, including indirect impacts, to watercourses, riparian areas, aquatic habitats and threatened aquatic species, where feasible and reasonable.	Design and construction
B3	A Construction Flora and Fauna Management Plan (CFFMP) will be prepared as part of the Construction Environmental Management Plan (CEMP) in consultation with DPE. The CFFMP will be prepared in accordance with Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RMS 2011b) and Policy and Guidelines for Fish Habitat Conservation and Management Update 2013 (DPI, 2013), including: • a procedure for planning and carrying out clearing, including preclearance surveys, management of vegetation clearance, removal of bush rock and other habitat features, and a specific protocol for the identification and removal of hollow-bearing trees • delineation of the construction footprint and areas within it where vegetation will be retained in accordance with Guide 2 of the Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects (RMS, 2011b) • procedures for establishing and maintaining tree protection zones, including with reference to Australian Standard 4970-2009 Protection of Trees on Development Sites • procedures for managing and appropriately handling fauna that may be located within the construction footprint or affected by construction activities, and protocols for managing injured fauna in accordance with Guide 9: Fauna handling of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS, 2011b) • requirements for the installation of traffic signage and construction driver education on the risk of fauna related vehicle strikes, and procedures for removal of road carrion • measures for managing the presence of unexpected threatened species • procedures for re-establishing native vegetation, taking into account ecological values, opportunities to enhance habitat connectivity and landscaping requirements of the project, and replacing or re-installing habitat features such as woody debris, bushrock, and tree hollows • protocols for managing weeds and pathogens in accordance with Guide 6: Weed management and Guide 7: Pathogen management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS, 2011b)	Construction

ID	Environmental mitigation measure	Timing
	• measures to protect aquatic habitat and riparian areas, including runoff and water quality management (refer to measure SW1), in accordance with Guide 10: Aquatic habitats and riparian zones of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RMS, 2011b) and section 3.3.2 Standard precautions and mitigation measures of the Policy and guidelines for fish habitat conservation and management (DPI, 2013).	
B4	Rehabilitation and landscaping of the construction footprint following completion of construction will seek to maximise the use of locally endemic native species and to enhance habitat connectivity across the Great Western Highway corridor where feasible and reasonable, consistent with the landscape plan for the project.	Design and construction
B5	Consideration will be given to the design of culverts under surface roads to act as potential fauna crossing points and habitat resources for microbat species.	Design
B6	Native vegetation cleared from the construction footprint will be mulched and reused in site rehabilitation, stabilisation and landscaping where appropriate.	Construction
B7	Potential lighting/ overshadowing effects from the project on flora and fauna will be minimised where reasonable and feasible, including design and implementation of lighting during construction and operation taking into account: • minimum lighting requirements and design standards to maintain safety during construction and safety for operational traffic • guidance on the management of obtrusive lighting effects in AS4282-1997: Control of the Obtrusive Effects of Outdoor Lighting • guidance on good lighting principles provided in Part 4 of Dark Sky Planning Guideline (DPE, 2016a).	Design and construction
B8	Opportunities to minimise the risk of fauna strikes during construction and operation of the project will be considered during further design development and construction planning. This may include the installation of temporary fencing or other barriers near construction sites.	Design and construction
B9	The Biodiversity Assessment Method (BAM) will be used to review and update biodiversity offset requirements based on the final detailed design for the project. Biodiversity offsets for the project will be secured in accordance with the NSW Biodiversity Offset Scheme (BOS).	Design
B10	Based on the updated numerical groundwater model for the project (refer to environmental mitigation measure GW1), and groundwater and surface water monitoring data (refer to environmental mitigation measures GW2 and SW2), further consideration of the potential impacts of the project on groundwater dependent ecosystems along Greaves Creek as a consequence of groundwater drawdown and/ or reduction in watercourse baseflow will be carried out during further design development. Subject to the outcomes, options to avoid and/ or minimise anticipated impacts will be identified, and implemented if reasonable and feasible.	Design

ID	Environmental mitigation measure	Timing
B11	Swamp extent and PCT mapping will be carried out for the *Biodiversity Conservation Act 2016* (NSW) and *Environmental Protection and Biodiversity Conservation Act 1999* listed peat swamps (GDEs) on Greaves Creek and Butlers Creek prior to the commencement of construction, followed by seasonal swamp extent mapping and species composition assessment to assess change in swamp dynamics for a period of two years post-construction.	Design and operation
B12	Ground settlement predictions will be considered based on further design development. If cliff top areas are identified as potentially experiencing settlement of 20 millimetres or more, monitoring and management measures will be identified based on a Before After Control Impact (BACI) approach.	Design, construction and operation
B13	Interruptions to water flows associated with groundwater dependent ecosystems will be minimised through the use of design features such as bioretention systems and flow spreaders.	Design
B14	Bioretention systems will be unlined to allow infiltration of treated stormwater directly into the surrounding soils and will also include usage of engineered filter media augmented with organic carbon to provide appropriate pH buffering. The bioretention system will be planted with native flora species that are representative of the surrounding PCTs.	Design
Groundwater and geology		
GW1	The numerical groundwater model for the project will be updated as part of ongoing design development, will consider the construction schedule and methodology, and will take into account relevant additional geotechnical and groundwater monitoring data. Anticipated groundwater impacts will be confirmed and if required inform the development of detailed groundwater mitigation and management measures. The updated numerical groundwater numerical model will be calibrated against groundwater monitoring data collected during the construction phase. If observed groundwater level responses identified through monitoring markedly differ from predictions made by the updated numerical groundwater model, including extent of drawdown and timing, the model will be further refined and calibrated against the observed groundwater conditions.	Design
GW2	Where the updated groundwater model predicts groundwater impacts or related baseflow reductions in surface water resources that markedly differ from predictions presented in the EIS, further environmental mitigation measures and/or design responses will be identified and applied where feasible and reasonable. Design responses could include the review of tanked or drained infrastructure elements, pre-grouting of cross-passages and/or the treatment and discharge of treated groundwater into the affected creeks to address baseflow reductions.	Design

ID	Environmental mitigation measure	Timing
GW3	As part of detailed design, the existing groundwater monitoring network will be reviewed and maintained in consultation with relevant government agencies, and monitoring data will be made available to those agencies upon request, to: • continue to gather representative groundwater monitoring data to inform ongoing project design development, and the updated numerical groundwater model for the project • characterise the hydrogeological environment along and around Greaves Creek and associated groundwater dependent ecosystems in more detail • monitor groundwater prior to, during, and after construction of the project • complement the surface water monitoring network for the project (refer to environmental mitigation measure SW2). A suitably qualified person, such as a hydrogeologist and/or an environmental scientist will undertake periodic reviews of the groundwater monitoring data, and advise on potential groundwater impacts and appropriate mitigation and management measures prior to, during and after construction of the project for up to two years.	Design
GW4	Registered groundwater bores identified as being potentially impacted by two or more metres of drawdown in the updated numerical groundwater model, will be inspected in consultation with the relevant groundwater licence holders. The inspection will aim to confirm the current viability of the bores. If the bores are identified to be viable, they will be monitored and if a material loss of yield occurs as a consequence of the project, make good provisions will be offered to the relevant groundwater licence holders.	Design
GW5	An updated assessment of potential ground settlement as a consequence of tunnel construction activities will be carried out as part of further design development at appropriate locations above the tunnel alignment. Where the assessment or monitoring data identifies an exceedance, or potential for an exceedance, of the acceptance criteria for settlement for buildings/ structures, heritage items and other sensitive buildings, or critical infrastructure, additional mitigation measures will be identified, which may include design and construction measures, and/ or reparatory works to affected buildings, structures or infrastructure.	Construction
Surface water and flooding		
SW1	A Construction Soil and Water Management Plan (CSWMP) will be prepared as part of the Construction Environmental Management Plan (CEMP) in consultation with relevant government agencies and local councils. The CSWMP will be prepared and implemented to detail measures to minimise erosion and sedimentation, manage surface water and flooding, and protect local water quality during construction, including the potential impacts of high risk construction activities to the Sydney Drinking Water Catchment and the Blue Mountains Special Area. The CSWMP will include: • erosion and sediment control measures prepared by or in consultation with a soil conservationist to be applied to each	Construction

ID	Environmental mitigation measure	Timing
	construction site, consistent with the guidance in *Managing Urban Stormwater – Soils and Construction (4th Edition)* (Landcom, 2004). Specific control measures may include: - diversion of runoff from undisturbed areas of the catchment around project disturbance areas - diversion of existing drainage lines disturbed by construction, or establishment of an alternative drainage line - construction and commissioning of sediment and water quality basins before major earthworks. Where projects overlap, the sizing of basins would account for the concurrent construction catchments and common discharge locations shared between the east, central and west projects, and sizing would be modified as required to accommodate the construction catchments. - use of sediment management devices such as fencing, sandbags, coir logs and graded or lined earth or sandbag diversion bunds and banks - measures to divert or capture and filter water prior to discharge, such as drainage diversion channels to flush and sediment sumps or traps - scour protection and energy dissipaters at locations of high erosion risk - location and storage of construction materials, fuels, and chemicals, including controls where possible to minimise the risk of leaks, spills and other unintended releases - storage of materials clear of frequently flooded low-lying areas - stabilisation of the surface of batters and drains, including temporary works and diversions - regular inspections and responsive adaptive management to improve erosion and sedimentation control practices as required to achieve the outcomes of the Blue Book. This will include inspections at regular intervals and after large rainfall events. • planning and management of stockpile areas in accordance with *Stockpile Site Management Guideline* (RMS, 2011a) • progressive and timely stabilisation and rehabilitation of disturbed areas, taking into account the ultimate requirements of the Place Design and Landscape Plan (PDLP) for the project (refer to environmental mitigation measure LV1) • a spill management procedure to minimise the risk of release of construction materials, fuels, and chemicals from construction sites. The procedure will include: - management of chemicals, fuels and potentially polluting materials - any specialised containment, security and bunding requirements (refer to environmental mitigation measure HR02) - maintenance of plant and equipment - emergency management, including notification, response, and clean-up procedures • measures to manage construction activities in areas prone to flooding or inundation, particularly around Rosedale Creek, including: - daily monitoring of weather conditions, including rainfall forecasts, to provide advance warning of potential flooding or inundation	

ID	Environmental mitigation measure	Timing
	- cessation of relevant works and site security and stabilisation requirements in the event of a severe weather warning - site clean-up and recovery measures in the event of flooding or inundation • measures to manage acid sulfate rock, consistent with the Acid Sulfate Rock Management Plan (ASRMP) for the project (refer to environmental mitigation measure SC3).	
SW2	A surface water monitoring network will be maintained for the project to: • continue to gather baseline surface water monitoring data to inform ongoing design development, and the updated numerical groundwater model for the project • characterise the hydrological environment along and around Greaves Creek and associated groundwater dependent ecosystems • monitor surface water, including surface water quality, prior to, during and for two years after completion of construction of the project • complement the groundwater monitoring network for the project (refer to environmental mitigation measure GW3). The surface monitoring network will be developed in consultation with relevant government agencies, and monitoring data will be made available to those agencies upon request. A qualified hydrologist or environmental scientist or equivalently experienced professional will be engaged to periodically review surface water monitoring data, and to advise on potential surface water impacts and appropriate mitigation and management measures prior to, during and after construction of the project.	Design, construction and operation
SW3	Batters constructed as part of the project will be designed and implemented to minimise risk of exposure, instability, and erosion, and to support long-term, on-going best practice management, in accordance with *Guideline for Batter Surface Stabilisation using Vegetation* (RMS, 2015).	Design and construction
SW4	Construction wastewater, including water from each construction site and groundwater ingress collected during tunnel works, will be treated to a suitable standard prior to reuse and/ or discharge to the environment. Water quality criteria for discharges to the environment will be developed in consultation with relevant government agencies, and will be based on the need to achieve a neutral or beneficial effect on sensitive receiving waters and drinking water catchments.	Construction
SW5	Operational wastewater will be treated via a mix of water quality control basins and a wastewater treatment plant at Little Hartley to a suitable standard prior to reuse and/ or discharge to the environment as part of routine operations. Water quality criteria for discharges to the environment will be developed in consultation with relevant government agencies, and will be based on the need to achieve a neutral or beneficial effect on sensitive receiving waters and drinking water catchments.	Operation
SW6	Further design development will be carried out to minimise flooding impacts and to meet flood criteria identified for the project.	Design

ID	Environmental mitigation measure	Timing
Soils and contamination		
SC1	A Detailed Site Investigation (DSI) will be carried out for areas of environmental interest within the construction footprint identified as posing a medium or greater risk, in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended 2013) and other relevant guidelines. If the DSI identifies that remediation of contaminated land is required, a Remedial Action Plan will be developed and implemented in accordance with relevant guidelines and codes of practice. If required, remediation will be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land.	Design
SC2	An unexpected contamination finds procedure will be developed and implemented during construction of the project. The unexpected contamination finds procedure that includes a process for addressing unexpected contamination and will generally include provision for: • cessation of works within the affected area until inspection of the suspected contamination by a qualified contaminated lands specialist (verification by a certified contaminated land practitioner) • collection of soil samples for analysis based on observations • assessment of results against applicable land use or waste classification criteria in accordance with applicable statutory guidelines • management of the contamination in accordance with applicable statutory guidelines.	Construction
SC3	An Acid Sulfate Rock Management Plan (ASRMP) will be prepared as part of the Construction Environmental Management Plan (CEMP), taking into account the management guidelines in the *Acid Sulfate Soil Manual* (ASSMAC, 1998) and the *National Acid Sulfate Soils Guidance: National Sulfate Soils Identification and Laboratory Methods Manual* (Water Quality Australia, 2018). The ASRMP will include the process for identification, management and handling and re-use or disposal of acid sulfate rock.	Construction
Aboriginal cultural heritage		
AH1	If unexpected items of potential Aboriginal cultural heritage significance, including potential Aboriginal burials or skeletal material, are discovered during construction of the project, all relevant activities in the vicinity of the find will cease and the unexpected/chance finds requirements specified in the Unexpected Heritage Items Procedure (Transport for NSW, 2022d) will be followed.	Construction
Non-Aboriginal heritage		
NAH1	The Construction Environmental Management Plan (CEMP) for the project will include measures applicable to the Soldiers Pinch construction site to minimise the risk of accidents and incidents impacting on the nearby Greater Blue Mountains World Heritage Area. The CEMP will also include provision for construction workers at the	Construction

ID	Environmental mitigation measure	Timing
	Soldiers Pinch construction site to be made aware of the location and significance of the World Heritage Area as part of site inductions and environmental awareness training.	
NAH2	Opportunities to minimise the extent of native vegetation clearing within the footprint of the Greater Blue Mountains Area (Additional Values) National Heritage List nomination will be considered during further design development (refer to environmental mitigation measure B4). In areas where clearing native vegetation cannot be avoided, locally endemic native species will be used in landscaping to reflect the ecological heritage values in the nomination (refer to environmental mitigation measure LV2).	Design
NAH3	If unexpected items of potential non-Aboriginal heritage significance are discovered during construction of the project, all relevant activities in the vicinity will cease in the vicinity of the find and the Unexpected Heritage Items Procedure (Transport for NSW, 2022d) will be followed.	Construction
NAH4	A detailed archaeological survey will be carried out by a suitably qualified archaeologist within those parts of the Mount Victoria Stockade site and the potential Plough Inn site that would be directly affected by construction of the project, and which have not been previously disturbed/ surveyed by the Little Hartley to Lithgow Upgrade project. The detailed archaeological survey will be carried out prior to ground disturbance by the project, and will assess site features, potential for archaeological deposits, significance and proposed management measures.	Design
NAH5	The potential for construction activities to impact remaining sections of Cox's Road (1814) within the Soldiers Pinch construction site that have not been previously disturbed will be investigated as part of further design development. If construction activities at Soldiers Pinch are likely to affect remaining sections of Coxs Road, a detailed archaeological survey will be carried out to map those remaining sections prior to the commencement of ground disturbing works.	Design
NAH6	Construction planning for the project will aim to avoid the use of vibration intensive plant and equipment within the minimum separation distances from the Rosedale homestead, for that plant and equipment (refer to measure NV8). Where minimum separation distances cannot be achieved: • a condition/ dilapidation survey of the Rosedale homestead will be completed prior to and at the completion of the relevant construction works • vibration monitoring will be carried out at the Rosedale homestead during the relevant construction works.	Design
NAH7	The project will be designed and constructed so that tunnelling does not exceed the structural damage criteria (peak particle velocity) for structures that are particularly sensitive to vibration and have intrinsic value, as detailed in German standard *DIN 4150-3: 1992-02 Vibration in Buildings – Part 3: Effects on Structures*, at any heritage building/ structure (refer to environmental mitigation measure GW5).	Design and construction

ID	Environmental mitigation measure	Timing
NAH8	Opportunities to retain existing mature vegetation within and along the Great Western Highway corridor at Little Hartley will be considered in coordination with the Little Hartley to Lithgow Upgrade project. If existing mature vegetation cannot be retained, alternative vegetation screening measures will be identified and implemented, such as landscaping associated with the project and/ or the Little Hartley to Lithgow Upgrade project, or plantings on the Rosedale property in consultation and with the agreement of the property owner and will be in keeping with the existing cultural values of heritage items surrounding the project.	Design
Landscape and visual		
LV1	A Place Design and Landscape Plan (PDLP) will be prepared to minimise landscape character and visual impacts, and detail and guide the implementation of landscape features to be installed as part of the project. This would include requirements for: • landscape and re-vegetation • the provision of vegetative screening to soften the appearance of structural elements of the project and provide screening of sensitive views to the project • requirements of the Aboriginal and non-Aboriginal cultural and heritage interpretation • site levels and grades for the project that integrate with the surrounding terrain to assist with the visual assimilation of the project into the surrounding landscape where practicable. The gradients of engineered slopes will seek to maximise the establishment of vegetation and allow for appropriate maintenance. The PDLP will be prepared in accordance with applicable guidelines, be consistent with the project identity in the EIS and relevant urban design objectives and principles for the project including consideration of implementation of Crime Prevention Through Environmental Design (CPTED) principles, and in consultation with the relevant councils.	Construction
LV2	As part of further design development, opportunities to visually integrate the project into the landscape, will be considered and will reflect the landscape and revegetation requirements identified in environmental mitigation measures for biodiversity and non-Aboriginal heritage. This will consider measures including: • retention and protection of existing trees where reasonable and feasible, particularly along the unaltered edges of the existing Great Western Highway • avoidance of formal rows of trees or blocks of shrub and grass plantings as these would be uncharacteristic within both the Blackheath and Little Hartley landscape settings • reinstatement of cleared native vegetation to achieve a net increase in tree numbers and canopy in proximity to the project that will not be covered by a biodiversity offset strategy • strategic placement and planting of vegetation in line with the surrounding landscape character zone(s) • sourcing locally endemic native species • carrying out appropriate soil analysis and identification of soil preparation requirements for landscaping treatments to inform the	Design

ID	Environmental mitigation measure	Timing
	PDLP and vegetation management in accordance with the *Batter Surface Stabilisation Guideline* (RMS, 2015).	
LV3	The Construction Environmental Management Plan (CEMP) will include specific measures to minimise the visual intrusion of construction areas and construction compounds.	Construction
LV4	Lighting employed during construction and operation will be minimised, taking into account: • minimum lighting requirements and design standards to maintain safety during construction and safety for operational traffic • guidance on the management of obtrusive lighting effects in *AS4282-1997: Control of the Obtrusive Effects of Outdoor Lighting* • guidance on good lighting principles provided in Part 4 of *Dark Sky Planning Guideline* (DPE, 2016a) • the biodiversity lighting requirements for the project (refer to environmental mitigation measure B8).	Design, construction and operation
Social impacts		
SI1	A Social Impact Management Plan (SIMP) will be prepared and implemented during construction and for the first three years of operation of the project. The SIMP will be prepared in consultation with the relevant local councils and will guide monitoring and adaptive management of social impacts resulting from the project. The SIMP will include details of: • desired social outcomes for the project • adaptive management and mitigation strategies to address potential impacts • a process of monitoring predicted social impacts against actual impacts • indicators used to monitor desired social outcomes • a process for reporting on social impacts • identification of appropriate stakeholder responsibilities. The SIMP will be developed taking into account the requirements of the Skills, Employment and Industry Development Strategy for the Great Western Highway Upgrade Program, and the environmental mitigation measures developed for potential business, land use and property impacts.	Construction and operation
SI2	Managers of social infrastructure located adjacent to the construction footprint (including Browntown Oval) will be notified of the timing and duration of construction works and engaged in relation to the management of potential impacts on the social infrastructure, with the aim of minimising potential disruptions to the use of the social infrastructure from construction activities.	Construction
SI3	Construction workers for the project will be employed from the local area, where possible, to manage the need for people to relocate to the area for the duration of construction, and to contribute to local employment opportunities.	Construction

ID	Environmental mitigation measure	Timing
SI4	A construction workforce accommodation strategy will be prepared to confirm workforce accommodation requirements and options, in order to minimise potential adverse impacts to the rental market and short-term accommodation availability. This strategy will include consultation with local councils to better understand the market and how worker demand may be managed.	Design and construction
SI5	Opportunities to encourage visitors to areas that are bypassed by the project will be identified in consultation with the relevant local councils and other relevant government agencies. This will include development and implementation of a directional signage strategy during construction and operation of the project, and in accordance with applicable traffic signage standards and guidelines. The strategy will be developed with the aim of signposting key locations along the project corridor, and identifying the range of services, businesses and social infrastructure within the bypassed areas.	Design, construction and operation
SI6	Stakeholder engagement activities carried out during construction will be accessible to a range of groups in the community. This will include, at a minimum, a range of engagement methods (including options for physical copies of engagement materials) and opportunities for translated materials, upon request.	Construction
Business, land use and property		
BU1	The Skills, Employment and Industry Development Strategy for the Great Western Highway Upgrade Program will be applied to the project, with project-specific measures developed and implemented during construction of the project, including: • opportunities to promote and deliver upskilling and training for the local workforce • a strategy for jobs, diversity and business initiatives to achieve local economic and social outcomes in areas affected by the project • a strategy, developed in consultation with the relevant local councils, to provide early notification and information to local business to allow time to prepare for and respond to changes in traffic during construction of the project. Project-specific skills, employment and industry development measures will be identified and implemented taking into account the requirements of, and to be complementary with, the Social Impact Management Plan (SIMP) for the project (refer to environmental mitigation measure SI1).	Construction
BU2	Access to local businesses will be maintained during construction of the project. If existing access arrangements cannot be maintained, an acceptable alternative access will be provided in consultation with the affected business owner.	Construction
LU1	Land temporarily occupied during construction but not acquired for permanent operational infrastructure will be rehabilitated to a condition comparable to its pre-construction state or as otherwise agreed, in consultation with the relevant landowner.	Construction
LU2	Landowners whose properties will be affected by temporary occupation during construction or partial acquisition will be consulted to determine	Construction

ID	Environmental mitigation measure	Timing
	appropriate measures to maintain property access and the potential need to relocate or alter infrastructure on the property.	
Resource use and waste management		
RW1	Construction materials will be sourced with a preference for Australian materials and prefabricated products with low embodied energy, where reasonable and feasible. Resource replacement opportunities will be identified for achieving circular economy outcomes under the NSW Waste and Sustainable Materials Strategy 2041 (DPIE, 2021b).	Design and construction
RW2	The Construction Environmental Management Plan (CEMP) will include specific measures to manage waste, including: • documenting expected waste types and volumes • procedures for managing waste materials including separation, recycling, treatment, and disposal in accordance with relevant guidelines • waste reporting requirements including the implementation of a waste register • the process for identifying waste re-use sites including approval requirements.	Construction
RW3	A Spoil Management Plan (SMP) will be prepared as part of the Construction Environmental Management Plan (CEMP). The SMP will detail spoil management measures including spoil storage and handling, spoil haulage routes, opportunities for spoil reuse and a framework for identifying spoil reuse sites.	Construction
RW4	The project will be designed and implemented with the aim of achieving the following during construction: • at least a 10 per cent reduction in water use during construction • source at least 33 per cent of the project's construction water requirements from non-potable sources • implement rainwater harvesting and reuse systems at construction sites.	Design and construction
RW5	Opportunities to reduce water consumption and to reuse and recycle water within the project will be considered during further design development and implemented during operation, where reasonable and feasible.	Design
RW6	Waste will be managed in accordance with applicable legislation, policies and guidelines, including the *Waste Avoidance and Resource Recovery Act 2001* and the NSW Waste and Sustainable Materials Strategy 2041 (DPIE, 2021b).	Construction and operation

ID	Environmental mitigation measure	Timing
Hazards and risk		
HR1	A Bushfire Management Plan (BMP) will be prepared and implemented during construction and operation of the project, in consultation with the NSW Rural Fire Service and Fire and Rescue NSW. The BMP will be prepared in accordance with Planning for Bush Fire Protection 2019 (NSW Rural Fire Service, 2019) and AS 3959-2018 – Construction of Buildings in Bushfire-prone Area, and will include: • regular review of bushfire prone land mapping developed by the NSW Rural Fire Service near the project • monitoring of weather and local bushfire ratings • ensuring appropriate access arrangements are available in the event of a bushfire • operational requirements for community notifications in the event of a bushfire • ensuring plant and equipment are fitted with appropriate spark arrestors, where practicable • ensuring appropriate evacuation procedures for workers and the public in case of a bushfire • ensuring site workers are informed of the site rules including designated smoking areas and putting rubbish in designated bins • obtaining hot work permits and implementing total fire bans as required • implementing adequate storage and handling requirements for potentially flammable substances in accordance with relevant guidelines.	Design and construction
HR2	Dangerous goods required during construction and operation of the project will be stored and handled in accordance with the relevant guidelines including: • applicable Australian Standards • for liquids, a minimum bund volume requirement of 110% of the volume of the largest single stored volume, within the bund.	Construction and operation
HR3	Closed circuit television cameras will be installed to monitor traffic flows to enable early detection of incidents and queues in the tunnel.	Operation
Sustainability, climate change and greenhouse gas		
CC1	A climate change risk assessment will be carried as part of further design development. Adaptation actions will be identified and implemented to address extreme and high climate change risks, and will be considered for medium climate change risks where reasonable and feasible.	Design
SU1	An Infrastructure Sustainability Management Plan will be prepared and implemented as part of further design development to guide the implementation of sustainability initiatives. The Plan will detail how the project will achieve an Infrastructure Sustainability rating of ‘Excellent’.	Design
SU2	As part of further design development, construction and operation of the project, the initiatives identified in the Great Western Highway Upgrade Program’s Sustainability Strategy will be considered.	Design and operation

ID	Environmental mitigation measure	Timing
GG1	Opportunities to minimise greenhouse gas emissions from the project, including as a result of interactions with coal seams, will be identified as part of further design development, and will be implemented during construction and operation where reasonable and feasible. Consideration of opportunities to minimise greenhouse gas emissions will include: • reducing the electricity requirements of the project and/ or sourcing electricity from a renewable energy source • selecting construction materials with reduced embodied greenhouse gas emissions, through reduced materials use, lower emissions construction materials, and/ or local sourcing of materials • selecting plant and equipment with lower fuel/ electricity consumption and/ or greater energy efficiency.	Design, construction and operation
GG2	The project will be designed and implemented with the aim of achieving the following: • at least a 10 per cent reduction in carbon emissions during construction • offset at least 25 per cent of the carbon emissions associated with consumption of fuel and electricity through the purchase of approved offsets and/ or renewable energy during construction • at least a 10 per cent reduction in scope 1 greenhouse gas emissions using Climate Active Standard eligible offsets during construction • at least a 15 per cent reduction in carbon emissions during operation. A baseline against which the target reductions above will be evaluated will be established during detailed design, with reference to typical construction materials and methodologies, and operational processes and procedures, applied to other road tunnels in NSW.	Design, construction and operation
Cumulative impacts		
CI1	Opportunities to minimise and manage cumulative impacts across the Great Western Highway Upgrade Program will be identified in consultation with the other projects in the Upgrade Program, and implemented where reasonable and feasible. Key focus areas for the minimisation and management of potential cumulative impacts will include: • construction planning and staging, including coordination of construction activities and provision of respite periods to manage construction fatigue • coordination of stakeholder notification and engagement requirements and activities across the Upgrade Program to manage consultation fatigue • construction phase amenity, particularly in relation to traffic, dust, noise and vibration • avoidance and minimisation of impacts on biodiversity, Aboriginal heritage and non-Aboriginal heritage • coordination of waste and resource management, including spoil/ cut-and-fill balances, surface water management and water supply requirements, recycling and sustainability initiatives.	Design